WATER SUPPLY OUTLOOK
and
FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS
for
ARIZONA

UNITED STATES DEPARTMENT of AGRICULTURE···SOIL CONSERVATION SERVICE,
SALT RIVER VALLEY WATER USERS ASSOCIATION
and
ARIZONA AGRICULTURAL EXPERIMENT STATION

Data included in this report were obtained by the agencies named above in cooperation with the Federal, State and private organizations listed on the last page of this report.

BASED AS OF
APR. 1, 1962

UNITED STATES DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

To Recipients of Cooperative Snow Survey and Water Supply Forecast Reports:

The climate of the cultivated and populated areas of the West is characterized by relatively dry summer months. Such precipitation as occurs falls mostly in the winter and early spring months when it is of little immediate benefit to growing crops. Fortunately, most of this precipitation falls as mountain snow which stays on the ground for months, melting later to sustain streamflow during the period of greatest demand during late spring and summer. Thus, nature provides in mountain snow an imposing water storage facility.

The amount of water stored in mountain snow varies from place to place as well as from year to year and accordingly, so does the runoff of the streams. The best seasonal management of variable western water supplies results from fore-knowledge of the runoff.

A snow survey consists of a series of about ten samples taken with specially designed snow sampling equipment along a permanently marked line, about 1000 feet in length, called a snow course. The use of snow sampling equipment provides snow depth and water equivalent values for each sampling point. The average of these values is reported as the snow survey measurement for a snow course.

Snow surveys are made monthly or semi-monthly beginning in January or February and continue through the snow season until April, May or June. Currently more than 1400 western snow courses are measured each year. These measurements furnish the key data for water supply forecasts.

By relating snow survey measurements taken over a period of years to spring-summer runoff during the same period, relationships have been developed which make it possible to forecast seasonal runoff several months in advance of occurrence. In order to make a forecast, once a forecast relationship has been developed, the maximum snow water content at previously selected key snow courses is usually entered in the forecast relationship. More accurate forecasts are often obtained when other factors such as soil moisture, base flow and spring precipitation are considered and included in the forecast relationships.

Listed below are the Federal-State-Private Cooperative Snow Survey and Water Supply Forecast reports available for the West which contain detailed information on snow survey measurements, streamflow forecasts, reservoir storage, soil moisture and other guide data to water management and conservation decisions.

PUBLISHED BY SOIL CONSERVATION SERVICE

REPORTS	ISSUED	LOCATION	COOPERATING WITH
RIVER BASINS			
Colorado and State of Utah	Monthly (Jan.-June)	Salt Lake City, Utah	Utah State Engineer and Other Agencies
Columbia	Monthly (Jan.-May)	Boise, Idaho	Idaho State Reclamation Engineer
Upper Missouri and State of Montana	Monthly (Feb.-June)	Bozeman, Montana	Mont. Agr. Exp. Station
West-Wide	Oct. 1, Apr. 1, May 1	Portland, Oregon	All Cooperators
STATES			
Alaska	Monthly (Mar.-May)	Palmer, Alaska	Alaska S.C.D.
Arizona	Semi-Monthly (Jan.15 - Apr.1)	Phoenix, Arizona	Salt R. Valley Water Users Assoc. Ariz. Agr. Exp. Station
Colorado and New Mexico	Monthly (Feb.-May)	Fort Collins, Colorado	Colo. Agr. Exp. Station Colo. State Engineer N. Mex. State Engineer
Idaho	Monthly (Feb.-May)	Boise, Idaho	Idaho State Reclamation Engineer
Nevada	Monthly (Jan.-May)	Reno, Nevada	Nevada Dept. of Conservation and Natural Resources Division of Water Resources
Oregon	Monthly (Jan.-June)	Portland, Oregon	Ore. Agr. Exp. Station Oregon State Engineer
Washington	Monthly (Feb.-June)	Spokane, Washington	Wn. State Dept. of Conservation
Wyoming	Monthly (Feb.-June)	Casper, Wyoming	Wyoming State Engineer

Copies of these various reports may be secured from:

Head, Water Supply Forecasting Section
Soil Conservation Service
P.O. Box 4170, Portland 8, Oregon

PUBLISHED BY OTHER AGENCIES

REPORTS	ISSUED	AGENCY
British Columbia	Monthly (Feb.-June)	Comptroller, Water Rights Br., Dept. of Lands and Forests, Parliament Blog., Victoria, B.C., Canada
California	Monthly (Feb.-May)	Calif. Dept. of Water Resources, Sacramento, Calif.

USDA-SCS-PORTLAND, OREG. 1961

WATER SUPPLY OUTLOOK
and
FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS
for
ARIZONA

(Salt, Verde, Gila and Part of Lower Colorado River Basin)

Report prepared by

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SOIL CONSERVATION SERVICE
ROOM 6015 FEDERAL BUILDING
PHOENIX 25, ARIZONA

Issued by

ROBERT V. BOYLE
STATE CONSERVATIONIST
SOIL CONSERVATION SERVICE

VICTOR I. CORBELL
PRESIDENT
SALT RIVER VALLEY WATER USERS ASSOCIATION

ARIZONA
COOPERATIVE SNOW SURVEYS
Snow Courses and Sub-Watersheds

JANUARY 1962

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND OREG. 1960 M-2690

INDEX to SNOW COURSES and SOIL MOISTURE STATIONS

NUMBER **	NAME	SEC	TWP	RGE ***	ELEVATION	RIVER BASIN
11P3	Antelope Park	29	19N	8E	7300	Verde.....Discontinued
9S1	Baldy (p)	28	7N	27E	9125	Salt-Little Colorado
10T1	Bear Wallow	6	12S	16E	8100	Gila
9S6	Beaver Head	13	4N	30E	8000	Salt-Frisco
9S3	Big Lake Knoll	2	5N	28E	8800	Salt-Frisco-Little Colorado--Discontinued
7S3	Black Canyon	8	13S	11W****	6790	Gila.....Discontinued
9S10-*	Black River Divide	11	6N	27E	9100	Salt-Little Colorado
12N1	Bright Angel	34	33N	3E	8400	Lower Colorado
12R1	Camp Wood	3	16N	6W	5700	Williams-Verde
10R3-M	Canyon Creek	18	11N	15E	7500	Salt-Little Colorado--Replaced by 10R7-M
10R7-M	Canyon Creek #2	18	11N	15E	7500	Salt-Little Colorado
11R2-M	Casner Park	19	18N	8E	6930	Verde
12P1-M	Chalender	27	22N	3E	7100	Verde
10R8-*	Corduroy Creek	Lat.34°07'N. Long.110°08'W.			§ 6000	Salt
9S9	Corn Creek (p)	Lat.33°45'N. Long.109°45'W.			§ 7730	Salt..... Not Read
8S3	Corner Mountain	7	10S	17W****	8850	Gila-Frisco..... Not Read
9S7	Coronado Trail	26	5N	30E	8000	Salt-Frisco
10R2	Elk	31	11N	14E	7600	Salt-Little Colorado...Discontinued
10R6	Forest Dale	2	9N	21E	6430	Salt-Little Colorado
11P2	Fort Valley	22	22N	6E	7350	Verde-Little Colorado
9R5	Ft. Apache	18	7N	27E	9160	Salt-Little Colorado
8S1-M	Frisco Divide	31	6S	20W****	8000	Frisco-Gila
12R4	Gaddes Canyon	11	15N	2E	7600	Verde-Agua Fria
10R5	Gentry	36	11N	15E	7600	Salt
11P1	Grand Canyon	21	30N	4E	7500	Lower Colorado
11R5	Happy Jack	30	17N	9E	7630	Verde
10R4	Heber (p)	28	11N	15E	7600	Salt-Little Colorado
8S6	Ice King	6	11S	18W	8020	Frisco-Gila
7S2	Inman	6	11S	10W****	7800	Gila
12R2	Iron Springs	22	14N	3W	6200	Williams-Verde
9S2	Maverick Fork (p)	13	6N	27E	9050	Salt
9R4	McKay Peak	13	7N	24E	8250	Salt..... Not Read
9R2-M	McNary	14	8N	23E	7200	Salt-Little Colorado
9R1	Milk Ranch	28	8N	23E	7000	Salt
12R3	Mingus Mountain	3	15N	2E	7100	Verde-Agua Fria
8S2	Mogollon	2	11S	19W****	7000	Frisco-Gila
11R4	Mormon Lake	13	18N	8E	7350	Verde-Little Colorado
11R3-M	Mormon Mountain	14	18N	8E	7500	Verde
11R1-M	Munds Park	7	18N	7E	6500	Verde
8S4	N-Bar Lake	16	10S	17W****	8600	Gila..... Not Read
8S5	Negrito	6	10S	16W****	8200	Gila..... Not Read
9S4	Nutrioso	23	6N	30E	8500	Salt-Frisco-Little Colorado
9S5	Pacheta	At Town of Maverick, Ariz.			7800	Salt
8S7	Redstone Trail	5	11S	18W	8600	Frisco-Gila
9N1	Roof Butte	15	8N	6W*****	8500	Little Colorado... Not Read
10T2	Rose Canyon	15	12S	16E	7300	Gila
11P4	Snow Bowl	36	23N	6E	10,260	Verde
9S8	State Line	6	6S	21W****	8000	Gila-Frisco
7S1	Taylor Creek	20	10S	10W****	7850	Gila
9R3	Trout Creek	5	7N	24E	6400	Salt..... Not Read
8N1	Washington Pass	Lat.36°05'N. Long.108°50'W			8600	Little Colorado- Not Read
13P1	Willow Ranch	16	21N	11W	5000	Williams
10R1	Woods Canyon	15	11N	13E	7640	Salt-Little Colorado--Discontinued
10S1	Workman Creek	33	6N	14E	6900	Salt

* Soil Moisture Station only

** Number indicates location of snow course within coordinate rectangle. Thus 9N1 is Course #1 in coordinate rectangle 9N.

*** All in Gila and Salt River Base and Meridian except where otherwise indicated.

**** New Mexico Principal Meridian

***** Navajo Base

M Soil Moisture Station installed on or in vicinity of snow course.

§ Unsurveyed

(p) Storage gage installed on or in vicinity of snow course.

ARIZONA WATER SUPPLY OUTLOOK

APRIL 1, 1962

* *
* The water supply outlook for Arizona is very good. *
* Runoff has been high during February and March, *
* and snow pack is still far above average. *
* Streamflow forecasts are expected to be 240% of *
* average statewide. *
* *

SNOW COVER: Except for the last week, March temperatures have been below normal. Some melting has occurred, but not nearly as much as would be expected by this time of year. The snow pack on the Gila and Verde River Watersheds are 250% of average, while the snow cover on the Salt River Watershed is 432% of average for April 1.

RESERVOIR STORAGE: In spite of high discharges from reservoirs for early irrigation, the reservoir storage on the Salt River Project increased by 58,000 acre feet between March 15 and April 1. The Salt River Project Reservoirs are now 140% of average, and 54% of capacity. Discharge from San Carlos Reservoir has been greater than inflow which resulted in a drop in storage of 9,300 acre feet. Lake Pleasant gained 2,300 acre feet, but is still only 61% of average and 11% of capacity. Most small reservoirs in Northern Arizona are full or filling fast.

SOIL MOISTURE: Soil moisture at the higher elevations is still at field capacity or above, and additional precipitation will result in high runoff. At lower elevations on the watershed the soil is drying out on the surface.

STREAM FLOW AND WATER SUPPLY: Stream flow has been good during March in spite of the cold temperatures. The Salt River Project Rivers produced 210,400 acre feet, and the Gila at the head of the Safford Valley flowed 36,230 acre feet.

Runoff forecasts on the Salt River Project streams total 439,000 acre feet for the April-May period. This is 231% of the fifteen-year average. Prospects are even brighter on the Gila and Little Colorado Rivers with forecasts of 265% and 417% of average respectively.

With above average surface water conditions this year, less supplemental pumped water will be required.

STREAM FLOW FORECASTS - APRIL 1, 1962

The following summarized runoff forecasts are based principally on mountain snow cover and on the assumption that precipitation and temperature will be near average from the present time to the end of the forecast period. Appreciable deviations from normal of temperature and/or precipitation will correspondingly modify these forecasts.

SUB-WATERSHED, STREAM and STATION	SEASONAL STREAM FLOW IN THOUSANDS OF ACRE FEET FORECAST PERIOD APRIL - MAY INCLUSIVE					
	Forecast Runoff 1962	Percent 15-Year Average	Measured Runoff 1961	1960	1959	1943-57 Average
Salt River at Intake	340	271	44.3	139.4	22.1	125.3
Tonto River above Roosevelt	15	183	2.5	6.4	1.5	8.2
Verde River above Horseshoe	84	148	32.0	24.1	18.3	56.5
Gila River at Virden	37	270	7.6	19.6	3.7	13.7
Frisco River at Clifton	36	263	6.5	17.4	4.5	13.7
Little Colorado River above Lyman Dam *	20	417	0.7	6.8	0.3	4.8

* Forecast period for Little Colorado River above Lyman Dam is for April - June, inclusive.

STATUS OF ARIZONA RESERVOIR STORAGE - ABOUT APRIL 1, 1962

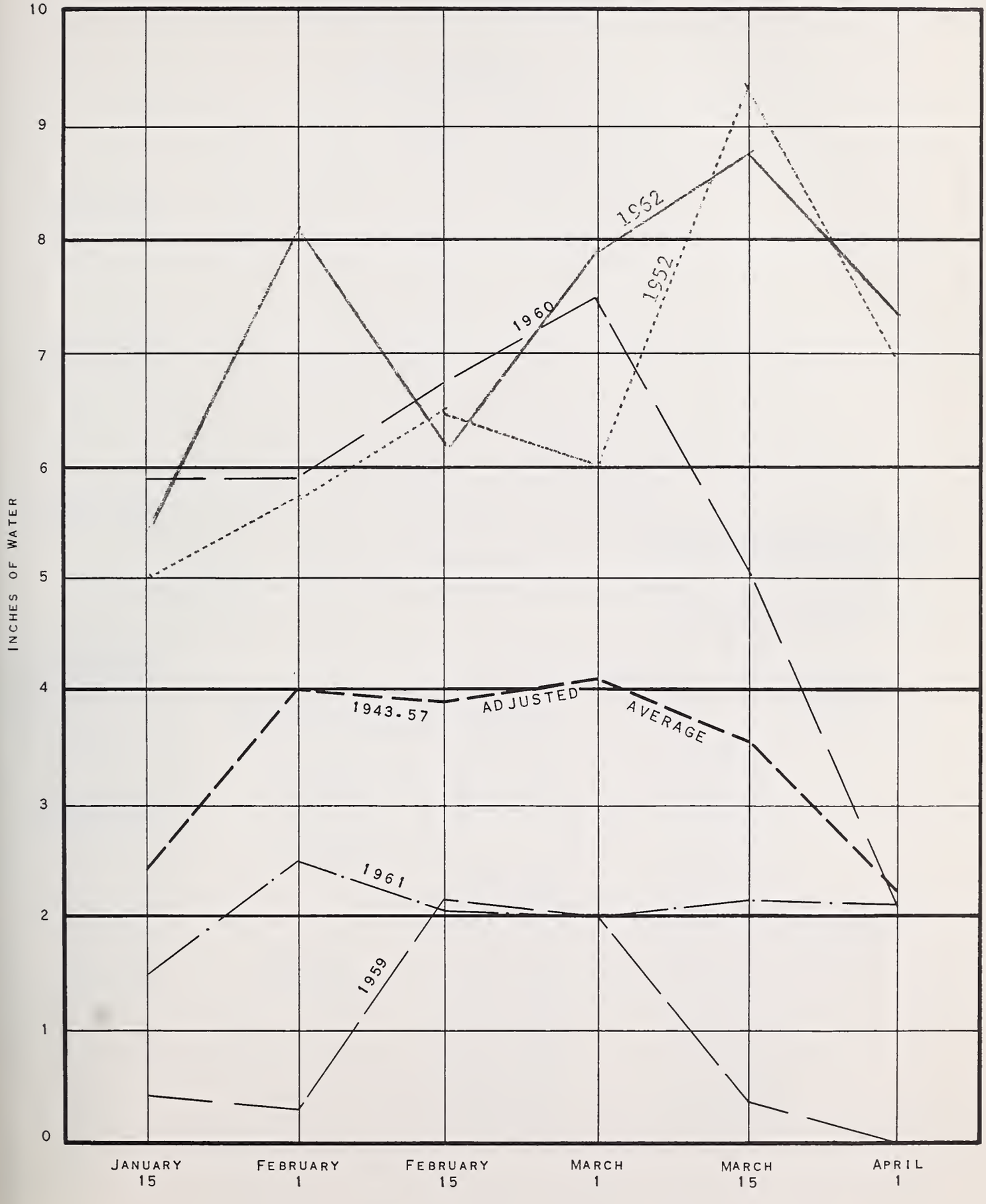
SUB-WATERSHED and/or STREAM	RESERVOIR	USABLE CAPACITY 1000s AC. FT.	USABLE STORAGE - 1000s ACRE FEET			
			1962	1961	1960	15-Year Average 1943-57
GILA RIVER SUB-WATERSHED						
Agua Fria	Lake Pleasant	163.8	18.1	26.6	49.7	29.8
Gila	San Carlos	1,206.0	154.4	0.3	214.7	107.9
Verde	Bartlett	179.5	68.7	29.4	145.0	70.9
Verde	Horseshoe	142.8	35.9	16.3	75.9	30.6 *
Salt	Roosevelt	1,382.0	773.7	816.9	1,021.9	471.7
Salt	Apache	245.0	230.9	213.1	235.4	209.7
Salt	Canyon	58.0	54.0	45.3	57.7	46.3
Salt	Saguaro	70.0	63.9	63.2	65.9	49.6
LOWER COLORADO RIVER SUB-WATERSHED						
Colorado	Lake Havasu	619.4	557.3	570.7	547.0	582.8
Colorado	Lake Mohave	1,810.0	1,707.0	1,684.0	1,568.0	1,491.8 *
Colorado	Lake Mead	27,207.0	18,041.0	18,212.0	19,180.0	16,438.0
Little Colorado	Lyman	30.6	5.5	6.8	16.7	6.8
Little Colorado	Show Low Lake	5.1	5.1	0.2	5.1	--

* Average is for less than 15 years of record in the 1943-57 period.

RELATIVE SNOW WATER ACCUMULATION

ARIZONA

APRIL 1, 1962

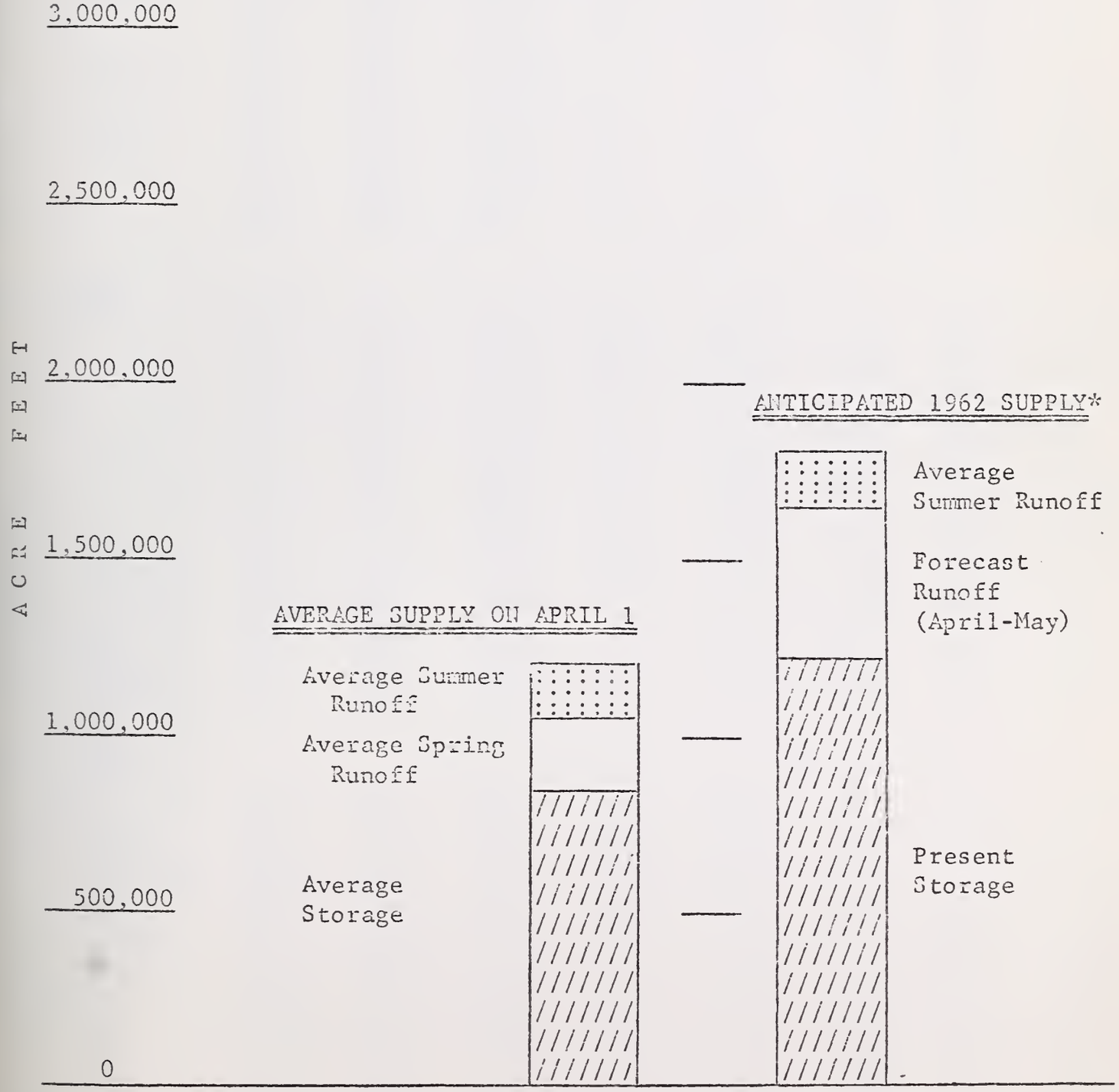


This graph represents the average snow water content on eleven selected snow courses on Arizona Sub-Watersheds.

WATER SUPPLY INVENTORY

SALT RIVER VALLEY SYSTEM

APRIL 1, 1962



* Based on present Storage + Forecast Spring runoff + Average Summer runoff.

ARIZONA SNOW SURVEYS - ABOUT APRIL 1, 1962

SUB-WATERSHED and SNOW COURSE	No.	Elev.	SNOW COVER MEASUREMENTS 1962 Date of Survey	Snow Depth (In.)	Water Content (In.)	PAST RECORD Water Content (Inches) 1961	1960	1943-57 Average
GILA RIVER								
Redstone Trail	8S7	8600	4/1	34	14.0	5.7	---	---
Nutrioso	9S4	8500	3/30	5	1.9	0.0	0.0	0.5
Bear Wallow	10T1	8100	3/31	32	13.3	1.1	10.5	1.3 **
Frisco Divide	8S1-M	8000	3/30	4	1.3	0.0	0.0	0.5
Ice King	8S6	8000	4/1	34	13.2	5.2	---	---
State Line	9S8	8000	3/30	2	0.8	0.0	0.0	0.5
Coronado Trail	9S7	8000	3/30	2	0.9	0.0	0.0	1.1
Beaver Head	9S6	8000	3/31	11	4.3	0.4	0.6	0.8
Taylor Creek	7S1	7850	3/29	0	0.0	T	0.0	0.0
Inman	7S2	7800	3/29	0	0.0	T	0.0	0.0 **
Rose Canyon	10T2	7300	3/31	13	5.5	0.6	0.0	0.2 **
Mogollon	8S2	7000	4/1	T	T	0.5	0.0	0.3 **
SALT RIVER								
Ft. Apache *	9R5	9160	3/28	48	16.9	5.1	7.6	5.6 **
Baldy *	9S1	9125	3/28	47	17.4	4.9	6.1	4.2 **
Maverick Fork	9S2	9050	3/28	55	19.6	4.9	8.2	6.0 **
Nutrioso	9S4	8500	3/30	5	1.9	0.0	0.0	0.5
Coronado Trail	9S7	8000	3/30	2	0.9	0.0	0.0	1.1
Beaver Head	9S6	8000	3/31	11	4.3	0.4	0.6	0.8
Pacheta	9S5	7800	3/30	16	6.6	0.0	0.0	0.4 **
Gentry	10R5	7600	3/29	14	5.3	1.3	0.0	0.8 **
Heber	10R4	7600	3/29	18	6.4	1.8	0.9	1.2 **
Canyon Creek #2	10R7-M	7500	3/29	19	6.7	0.9	T	---
McNary	9R2-M	7200	3/30	11	3.2	1.0	0.0	0.2
Milk Ranch	9R1	7000	3/30	0	0.0	0.7	0.0	0.0
Workman Creek	10S1	6900	3/30	33	14.6	1.4	---	1.7 **
Forest Dale	10R6	6430	3/30	0	0.0	0.4	0.0	0.0
VERDE RIVER								
Snow Bowl	11P4	10260	3/28	51	18.6	6.4	---	---
Happy Jack	11R5	7630	3/30	18	7.3	2.2	0.0	2.7 **
Gaddes Canyon	12R4	7600	3/30	30	9.9	2.4	2.6	---
Mormon Mountain	11R3-M	7500	3/30	29	11.6	2.5	T	5.4 **
Mormon Lake *	11R4	7350	3/30	19	7.5	2.1	0.0	3.7 **
Fort Valley *	11P2	7350	3/30	14	4.6	2.3	0.0	1.4 **
Mingus Mountain	12R3	7100	3/30	0	0.0	1.1	0.0	0.1 **
Chalender	12P1-M	7100	3/30	12	4.2	0.9	0.0	1.6 **
Casner Park	11R2-M	6930	3/30	18	7.8	2.3	0.0	1.4 **
Munds Park	11R1-M	6500	3/29	5	1.8	1.8	0.0	1.4 **
Iron Springs *	12R2	6200	3/26	0	0.0	0.5	0.0	0.0 **
Camp Wood	12R1	5700	4/2	0	0.0	0.0	0.0	0.0 **

* On Adjacent Drainage
** 1943-57 Adjusted Average

ARIZONA SNOW SURVEYS - ABOUT APRIL 1, 1962

SUB-WATERSHED and SNOW COURSE	No.	Elev.	SNOW COVER MEASUREMENTS 1962 Date of Survey	Snow Depth (In.)	Water Content (In.)	PAST RECORD Water Content (Inches) 1961	1960	1943-57 Average
WILLIAMS RIVER								
Iron Springs	12R2	6200	3/26	0	0.0	0.5	0.0	0.0 **
Camp Wood *	12R1	5700	4/2	0	0.0	0.0	0.0	0.0 **
Willow Ranch	13P1	5000	3/30	0	0.0	0.0	0.0	0.0 **
LOWER COLORADO RIVER								
Bright Angel	12N1	8400	3/28	37	13.8	No Survey	---	10.4 **
Grand Canyon	11P1	7500	3/31	3	1.2	2.1	0.0	1.4 **
Fort Valley	11P2	7350	3/30	14	4.6	2.3	0.0	1.4 **
Chalender *	12P1-M	7100	3/30	12	4.2	0.9	0.0	1.6 **
LITTLE COLORADO RIVER								
Ft. Apache	9R5	9160	3/28	48	16.9	5.1	7.6	5.6 **
Baldy	9S1	9125	3/28	47	17.4	4.9	6.1	4.2 **
Nutrioso	9S4	8500	3/30	5	1.9	0.0	0.0	0.5
Happy Jack *	11R5	7630	3/30	18	7.3	2.2	0.0	2.7 **
Gentry	10R5	7600	3/29	14	5.3	1.3	0.0	0.8 **
Heber	10R4	7600	3/29	18	6.4	1.8	0.9	1.2 **
Canyon Creek #2	10R7-M	7500	3/29	19	6.7	0.9	T	---
Mormon Mountain	11R3-M	7500	3/30	29	11.6	2.5	T	5.4 **
Mormon Lake	11R4	7350	3/30	19	7.5	2.1	0.0	3.7 **
Fort Valley	11P2	7350	3/30	14	4.6	2.3	0.0	1.4 **
McNary	9R2-M	7200	3/30	11	3.2	1.0	0.0	0.2
Forest Dale	10R6	6430	3/30	0	0.0	0.4	0.0	0.0

* On Adjacent Drainage
** 1943-57 Adjusted Average

LIST OF SNOW SURVEYORS

SNOW COURSE	SURVEYOR
Baldy	SCS and SRVWUA
Bear Wallow	Forest Service - David Park
Beaver Head	N. A. Josh
Bright Angel	National Park Service
Camp Wood	Mrs. C. C. Merritt
Canyon Creek #2	SCS and SRVWUA
Casner Park	SCS and SRVWUA
Chalender	Forest Service - MacIntyre
Coronado Trail	Forest Service - Bill Brainard & W. L. Sanders
Forest Dale	Fort Apache Reservation - Boyer and Endfield
Frisco Divide	Forest Service - Joe Clayton
Ft. Apache	SCS and SRVWUA
Fort Valley	Rocky Mountain Forest & Range Experiment Station
Gaddes Canyon	SCS - Bill Gray
Gentry	SCS and SRVWUA
Grand Canyon	National Park Service - Robt. Heyder
Happy Jack	Emil O. Ryberg
Heber	SCS and SRVWUA
Ice King	James R. Wray
Inman	C. H. McCauley
Iron Springs	Ernest Saxby
McNary	Fort Apache Reservation - Boyer and Endfield
Maverick Fork	SCS and SRVWUA
Milk Ranch	Fort Apache Reservation - Boyer and Endfield
Mingus Mountain	SCS - Bill Gray
Mogollon	James R. Wray
Mormon Lake	SCS and SRVWUA
Mormon Mountain	SCS and SRVWUA
Munds Park	SCS and SRVWUA
Nutrioso	Forest Service - Bill Brainard & W. L. Sanders
Pacheta	Foch Phillips
Redstone Trail	James R. Wray
Rose Canyon	Forest Service - David Park
Snow Bowl	Forest Service - Jay Shoemaker
State Line	Forest Service - Joe Clayton
Taylor Creek	C. H. McCauley
Willow Ranch	Tiny Miller
Workman Creek	Rocky Mountain Forest & Range Experiment Station

The Following Organizations Cooperate in the Arizona Snow Survey Work

FEDERAL

- Department of Agriculture
  - Soil Conservation Service
  - Forest Service
    - Apache Forest
    - Coconino Forest
    - Coronado Forest
    - Gila Forest
    - Kaibab Forest
    - Prescott Forest
    - Rocky Mountain Forest and Range Experiment Station
    - Tonto Forest
- Department of Commerce
  - Weather Bureau
    - Arizona Section
- Department of Interior
  - Bureau of Reclamation
    - Region III
  - Geological Survey
    - Arizona District
  - Bureau of Indian Affairs
    - Fort Apache Reservation
    - San Carlos Irrigation Project
  - National Park Service
    - Grand Canyon National Park
- Gila Water Commissioner
  - Safford, Arizona

STATE

- Arizona Agricultural Experiment Station

IRRIGATION PROJECTS

- Salt River Valley Water Users' Association
  - Phoenix, Arizona
- San Carlos Irrigation and Drainage District
  - Coolidge, Arizona

PRIVATE

- Southwest Lumber Mills, Inc.
  - McNary, Arizona

Other organizations and individuals furnish valuable information for the snow survey reports. Their cooperation is gratefully acknowledged.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ROOM 6015 FEDERAL BUILDING
PHOENIX 25, ARIZONA

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FEDERAL - STATE - PRIVATE

COOPERATIVE SNOW SURVEYS

Furnishes the basic data necessary for forecasting water supply for irrigation, domestic and municipal water supply, hydro-electric power generation, navigation, mining and industry

"The Conservation of Water begins with the Snow Survey"

WATER SUPPLY OUTLOOK
and
FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS
for
ARIZONA

UNITED STATES DEPARTMENT of AGRICULTURE···SOIL CONSERVATION SERVICE
SALT RIVER VALLEY WATER USERS ASSOCIATION
and
ARIZONA AGRICULTURAL EXPERIMENT STATION

Data included in this report were obtained by the agencies named above in cooperation with the Federal, State and private organizations listed on the last page of this report.

AS OF
APR. 15, 1962

UNITED STATES DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

To Recipients of Cooperative Snow Survey and Water Supply Forecast Reports:

The climate of the cultivated and populated areas of the West is characterized by relatively dry summer months. Such precipitation as occurs falls mostly in the winter and early spring months when it is of little immediate benefit to growing crops. Fortunately, most of this precipitation falls as mountain snow which stays on the ground for months, melting later to sustain streamflow during the period of greatest demand during late spring and summer. Thus, nature provides in mountain snow an imposing water storage facility.

The amount of water stored in mountain snow varies from place to place as well as from year to year and accordingly, so does the runoff of the streams. The best seasonal management of variable western water supplies results from fore-knowledge of the runoff.

A snow survey consists of a series of about ten samples taken with specially designed snow sampling equipment along a permanently marked line, about 1000 feet in length, called a snow course. The use of snow sampling equipment provides snow depth and water equivalent values for each sampling point. The average of these values is reported as the snow survey measurement for a snow course.

Snow surveys are made monthly or semi-monthly beginning in January or February and continue through the snow season until April, May or June. Currently more than 1400 western snow courses are measured each year. These measurements furnish the key data for water supply forecasts.

By relating snow survey measurements taken over a period of years to spring-summer runoff during the same period, relationships have been developed which make it possible to forecast seasonal runoff several months in advance of occurrence. In order to make a forecast, once a forecast relationship has been developed, the maximum snow water content at previously selected key snow courses is usually entered in the forecast relationship. More accurate forecasts are often obtained when other factors such as soil moisture, base flow and spring precipitation are considered and included in the forecast relationships.

Listed below are the Federal-State-Private Cooperative Snow Survey and Water Supply Forecast reports available for the West which contain detailed information on snow survey measurements, streamflow forecasts, reservoir storage, soil moisture and other guide data to water management and conservation decisions.

PUBLISHED BY SOIL CONSERVATION SERVICE

REPORTS	ISSUED	LOCATION	COOPERATING WITH
RIVER BASINS			
Colorado and State of Utah	Monthly (Jan.-June)	Salt Lake City, Utah	Utah State Engineer and Other Agencies
Columbia	Monthly (Jan.-May)	Boise, Idaho	Idaho State Reclamation Engineer
Upper Missouri and State of Montana	Monthly (Feb.-June)	Bozeman, Montana	Mont. Agr. Exp. Station
West-Wide	Oct. 1, Apr. 1, May 1	Portland, Oregon	All Cooperators
STATES			
Alaska	Monthly (Mar.-May)	Palmer, Alaska	Alaska S.C.D.
Arizona	Semi-Monthly (Jan.15 - Apr.1)	Phoenix, Arizona	Salt R. Valley Water Users Assoc. Ariz. Agr. Exp. Station
Colorado and New Mexico	Monthly (Feb.-May)	Fort Collins, Colorado	Colo. Agr. Exp. Station Colo. State Engineer N. Mex. State Engineer
Idaho	Monthly (Feb.-May)	Boise, Idaho	Idaho State Reclamation Engineer
Nevada	Monthly (Jan.-May)	Reno, Nevada	Nevada Dept. of Conservation and Natural Resources Division of Water Resources
Oregon	Monthly (Jan.-June)	Portland, Oregon	Ore. Agr. Exp. Station Oregon State Engineer
Washington	Monthly (Feb.-June)	Spokane, Washington	Wn. State Dept. of Conservation
Wyoming	Monthly (Feb.-June)	Casper, Wyoming	Wyoming State Engineer

Copies of these various reports may be secured from:

Head, Water Supply Forecasting Section
Soil Conservation Service
P.O. Box 4170, Portland 8, Oregon

PUBLISHED BY OTHER AGENCIES

REPORTS	ISSUED	AGENCY
British Columbia	Monthly (Feb.-June)	Comptroller, Water Rights Br., Dept. of Lands and Forests, Parliament Bldg., Victoria, B.C., Canada
California	Monthly (Feb.-May)	Calif. Dept. of Water Resources, Sacramento, Calif.

USDA-SCS-PORTLAND, OREG. 1961

WATER SUPPLY OUTLOOK
and
FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS
for
ARIZONA

(Salt, Verde, Gila and Part of Lower Colorado River Basin)

Report prepared by

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SOIL CONSERVATION SERVICE

VICTOR I. CORBELL
PRESIDENT
SALT RIVER VALLEY WATER USERS ASSOCIATION

ARIZONA
COOPERATIVE SNOW SURVEYS
Snow Courses and Sub-Watersheds

JANUARY 1962

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OREG. 1960 M-2690

INDEX to SNOW COURSES and SOIL MOISTURE STATIONS

NUMBER **	NAME	SEC	TWP	RGE ***	ELEVATION	RIVER BASIN
11P3	Antelope Park	29	19N	8E	7300	Verde.....Discontinued
9S1	Baldy (p)	28	7N	27E	9125	Salt-Little Colorado
10T1	Bear Wallow	6	12S	16E	8100	Gila
9S6	Beaver Head	13	4N	30E	8000	Salt-Frisco
9S3	Big Lake Knoll	2	5N	28E	8800	Salt-Frisco-Little Colorado--Discontinued
7S3	Black Canyon	8	13S	11W****	6790	Gila.....Discontinued
9S10-*	Black River Divide	11	6N	27E	9100	Salt-Little Colorado
12N1	Bright Angel	34	33N	3E	8400	Lower Colorado
12R1	Camp Wood	3	16N	6W	5700	Williams-Verde
10R3-M	Canyon Creek	18	11N	15E	7500	Salt-Little Colorado--Replaced by 10R7-M
10R7-M	Canyon Creek #2	18	11N	15E	7500	Salt-Little Colorado
11R2-M	Casner Park	19	18N	8E	6930	Verde
12P1-M	Chalender	27	22N	3E	7100	Verde
10R8-*	Corduroy Creek	Lat.34°07'N. Long.110°08'W.			§ 6000	Salt
9S9	Corn Creek (p)	Lat.33°45'N. Long.109°45'W.			§ 7730	Salt..... Not Read
8S3	Corner Mountain	7	10S	17W****	8850	Gila-Frisco..... Not Read
9S7	Coronado Trail	26	5N	30E	8000	Salt-Frisco
10R2	Elk	31	11N	14E	7600	Salt-Little Colorado...Discontinued
10R6	Forest Dale	2	9N	21E	6430	Salt-Little Colorado
11P2	Fort Valley	22	22N	6E	7350	Verde-Little Colorado
9R5	Ft. Apache	18	7N	27E	9160	Salt-Little Colorado
8S1-M	Frisco Divide	31	6S	20W****	8000	Frisco-Gila
12R4	Gaddes Canyon	11	15N	2E	7600	Verde-Agua Fria
10R5	Gentry	36	11N	15E	7600	Salt
11P1	Grand Canyon	21	30N	4E	7500	Lower Colorado
11R5	Happy Jack	30	17N	9E	7630	Verde
10R4	Heber (p)	28	11N	15E	7600	Salt-Little Colorado
8S6	Ice King	6	11S	18W	8020	Frisco-Gila
7S2	Inman	6	11S	10W****	7800	Gila
12R2	Iron Springs	22	14N	3W	6200	Williams-Verde
9S2	Maverick Fork (p)	13	6N	27E	9050	Salt
9R4	McKay Peak	13	7N	24E	8250	Salt..... Not Read
9R2-M	McNary	14	8N	23E	7200	Salt-Little Colorado
9R1	Milk Ranch	28	8N	23E	7000	Salt
12R3	Mingus Mountain	3	15N	2E	7100	Verde-Agua Fria
8S2	Mogollon	2	11S	19W****	7000	Frisco-Gila
11R4	Mormon Lake	13	18N	8E	7350	Verde-Little Colorado
11R3-M	Mormon Mountain	14	18N	8E	7500	Verde
11R1-M	Munds Park	7	18N	7E	6500	Verde
8S4	N-Bar Lake	16	10S	17W****	8600	Gila..... Not Read
8S5	Negrito	6	10S	16W****	8200	Gila..... Not Read
9S4	Nutrioso	23	6N	30E	8500	Salt-Frisco-Little Colorado
9S5	Pacheta	At Town of Maverick, Ariz.			7800	Salt
8S7	Redstone Trail	5	11S	18W	8600	Frisco-Gila
9N1	Roof Butte	15	8N	6W*****	8500	Little Colorado... Not Read
10T2	Rose Canyon	15	12S	16E	7300	Gila
11P4	Snow Bowl	36	23N	6E	10,260	Verde
9S8	State Line	6	6S	21W****	8000	Gila-Frisco
7S1	Taylor Creek	20	10S	10W****	7850	Gila
9R3	Trout Creek	5	7N	24E	6400	Salt..... Not Read
8N1	Washington Pass	Lat.36°05'N. Long.108°50'W			8600	Little Colorado- Not Read
13P1	Willow Ranch	16	21N	11W	5000	Williams
10R1	Woods Canyon	15	11N	13E	7640	Salt-Little Colorado--Discontinued
10S1	Workman Creek	33	6N	14E	6900	Salt

* Soil Moisture Station only

** Number indicates location of snow course within coordinate rectangle. Thus 9N1 is course #1 in coordinate rectangle 9N.

*** All in Gila and Salt River Base and Meridian except where otherwise indicated.

**** New Mexico Principal Meridian

***** Navajo Base

M Soil Moisture Station installed on or in vicinity of snow course.

§ Unsurveyed

(p) Storage gage installed on or in vicinity of snow course.

ARIZONA WATER SUPPLY OUTLOOK

APRIL 15, 1962

* *
* The Water Supply Outlook for Arizona is still very good. *
* Runoff has been high so far in April, but stream flow *
* forecasts have been reduced slightly as a result of the *
* absence of precipitation for the past three weeks. *
* Runoff forecasts are twice average, and reservoir *
* storage is 143% of average. *
* *

SNOW COVER: The first April 15 snow survey made in many years revealed considerable snow pack still present above 9000'. At Maverick Fork there was 30" of snow containing 13.4" of water. At lower elevations the warm April temperatures have melted most of the snow. With the exception of Bright Angel, Ice King, and Redstone Trail, it may be assumed that there was no snow on the snow courses not reported in this survey.

RESERVOIR STORAGE: Increases in reservoir storage were obtained in spite of high irrigation use. The Salt River System gained 81,300 acre feet since April 1. Total stored water in the Salt River Project is now 1,308,300 acre feet. This is 145% of average and 63% of capacity.

Storage in San Carlos Reservoir increased 6,800 acre feet, while Lake Pleasant dropped slightly in the past two weeks. Lyman Reservoir storage increased over two times since April 1, with a gain of 6,800 acre feet.

STREAM FLOW AND WATER SUPPLY: Runoff has been high the last two weeks. The Salt, Verde, and Tonto Rivers flowed 116,700, 41,000 and 5,200 acre feet, respectively. The Verde River hit its peak on February 29 with 4600 cfs; it is now flowing 511 cfs. However, the Salt River is holding steady at 4800 cfs for the past several days; since it is fed by the high elevation area in the White Mountains, it is expected to remain high for several weeks.

The Little Colorado is flowing very high, having produced over 7000 acre feet so far in April. It is forecast to produce another 12,000 acre feet by July 1; this is about four times the average for this period.

SOIL MOISTURE: Soil moisture is still good at the intermediate and higher elevations. Very good runoff will still result from additional precipitation.

PRECIPITATION: Below normal precipitation was reported during March from most Arizona stations according to Paul C. Kangeiser of the U. S. Weather Bureau. During the first half of April there have been only traces of rainfall on the major watersheds. With the passing of each day it becomes increasingly less likely for a really good rain storm to occur.

STREAM FLOW FORECASTS - APRIL 15, 1962

The following summarized runoff forecasts are based principally on mountain snow cover and on the assumption that precipitation and temperature will be near average from the present time to the end of the forecast period. Appreciable deviations from normal of temperature and/or precipitation will correspondingly modify these forecasts.

SUB-WATERSHED, STREAM and STATION	SEASONAL STREAM FLOW IN THOUSANDS OF ACRE FEET FORECAST PERIOD APRIL - MAY INCLUSIVE					
	Forecast Runoff 1962	Percent 15-Year Average	Measured Runoff 1961	1960	1959	1943-57 Average
Salt River at Intake	305	243	44.3	139.4	22.1	125.3
Tonto River above Roosevelt	12	146	2.5	6.4	1.5	8.2
Verde River above Horseshoe	66	117	32.0	24.1	18.3	56.5
Gila River at Virden	35	255	7.6	19.6	3.7	13.7
Frisco River at Clifton	36	263	6.5	17.4	4.5	13.7
Little Colorado River above Lyman Dam *	19	396	0.7	6.8	0.3	4.8

* Forecast period for Little Colorado River above Lyman Dam is for April - June, inclusive.

STATUS OF ARIZONA RESERVOIR STORAGE - ABOUT APRIL 15, 1962

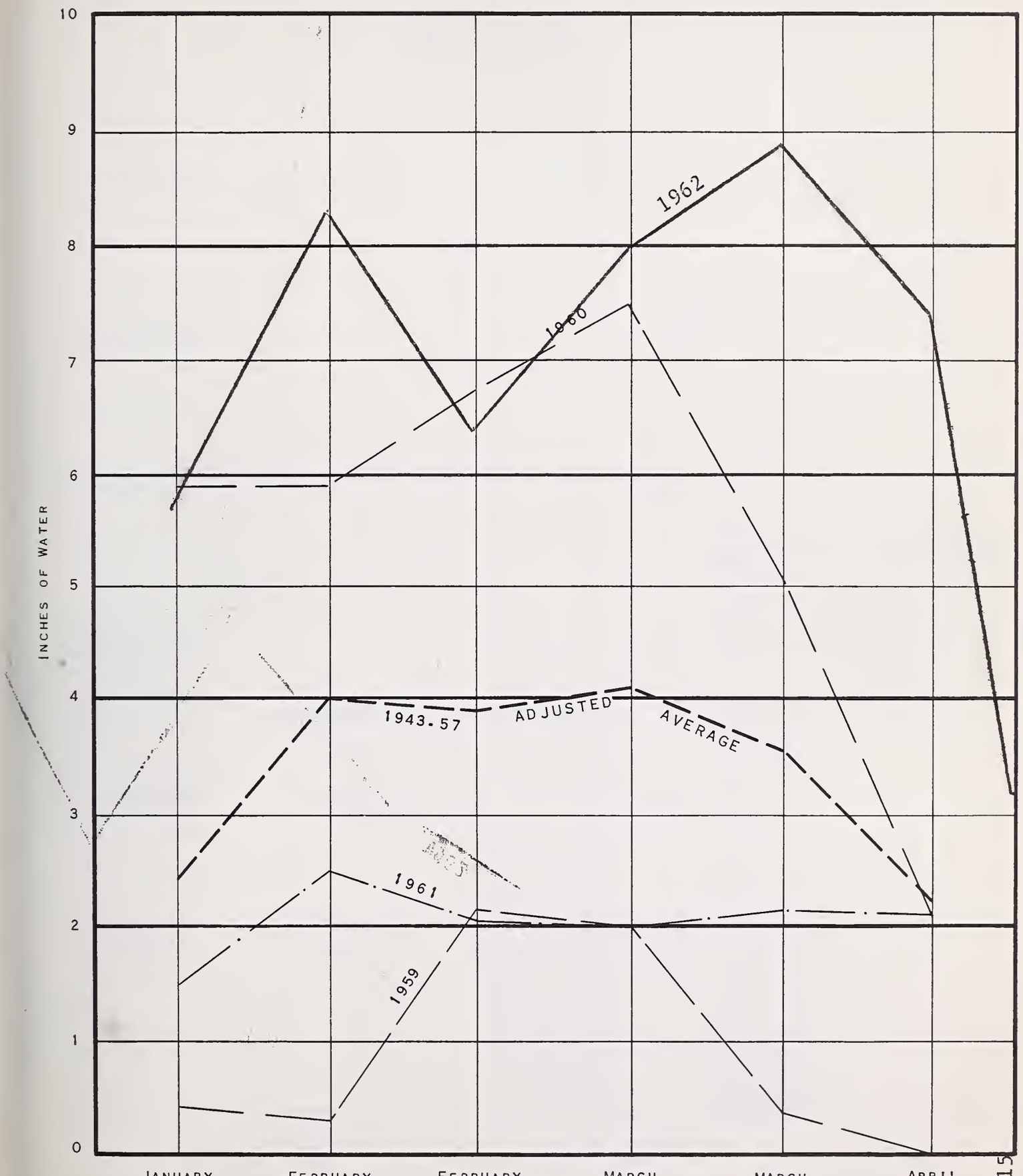
SUB-WATERSHED and/or STREAM	RESERVOIR	USABLE CAPACITY 1000s AC. FT.	USABLE STORAGE - 1000s ACRE FEET			
			1962	1961	1960	15-Year Average 1943-57
GILA RIVER SUB-WATERSHED						
Agua Fria	Lake Pleasant	163.8	18.1	26.4	49.4	29.9
Gila	San Carlos	1,206.0	161.3	0.3	204.8	102.4
Verde	Bartlett	179.5	68.4	26.0	125.3	75.7
Verde	Horseshoe	142.8	35.3	32.5	50.5	29.7 *
Salt	Roosevelt	1,382.0	842.7	811.6	1,072.0	484.1
Salt	Apache	245.0	242.9	197.2	234.4	216.0
Salt	Canyon	58.0	53.5	52.2	55.3	47.2
Salt	Saguaro	70.0	65.5	67.8	68.6	51.9
LOWER COLORADO RIVER SUB-WATERSHED						
Colorado	Lake Havasu	619.4	571.4	576.4	564.6	639.0
Colorado	Lake Mohave	1,810.0	1,687.8	1,706.0	1,514.0	1,485.8 *
Colorado	Lake Mead	27,207.0	18,428.0	18,032.0	19,449.0	16,335.0
Little Colorado	Lyman	30.6	12.3	7.1	20.3	7.9
Little Colorado	Show Low Lake	5.1	5.1	0.1	4.6	--

* Average is for less than 15 years of record in the 1943-57 period.

RELATIVE SNOW WATER ACCUMULATION

ARIZONA

APRIL 15, 1962

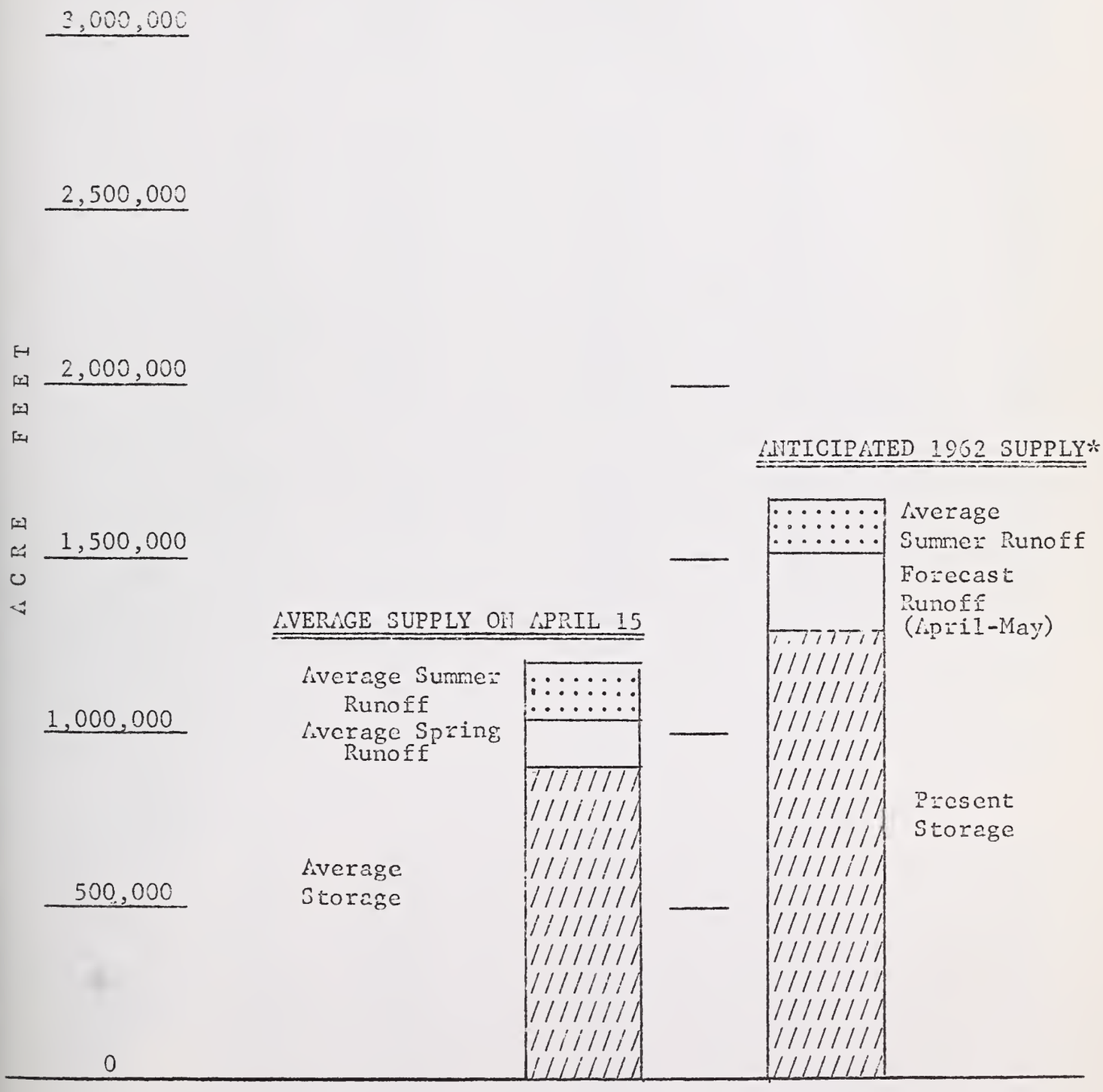


This graph represents the average snow water content on eleven selected snow courses on Arizona Sub-Watersheds.

WATER SUPPLY INVENTORY

SALT RIVER VALLEY SYSTEM

APRIL 15, 1962



* Based on present Storage + Forecast Spring runoff + Average Summer runoff.

ARIZONA SNOW SURVEYS - ABOUT APRIL 15, 1962

SUB-WATERSHED and SNOW COURSE	No.	Elev.	SNOW COVER MEASUREMENTS 1962		
			Date of Survey	Snow Depth	Water Content
GILA RIVER					
Bear Wallow	10T1	8100	4/16	5	2.4
Frisco Divide	8S1-M	8000	4/16	0	0.0
Beaver Head	9S6	8000	4/13	3	1.3
Rose Canyon	10T2	7300	4/16	0	0.0
SALT RIVER					
Ft. Apache *	9R5	9160	4/13	27	10.4
Baldy *	9S1	9125	4/13	22	8.7
Maverick Fork	9S2	9050	4/13	30	13.4
Beaver Head	9S6	8000	4/13	11	4.3
Pacheta	9S5	7800	4/13	0	0.0
Heber	10R4	7600	4/12	18	6.4
Canyon Creek #2	10R7-M	7500	4/12	1	0.5
McNary	9R2-M	7200	4/12	T	T
Workman Creek	10S1	6900	4/12	4	1.8
Forest Dale	10R6	6430	4/12	0	0.0
VERDE RIVER					
Snow Bowl	11P4	10260	4/13	39	15.4
Happy Jack	11R5	7630	4/13	0	0.0
Gaddes Canyon	12R4	7600	4/13	5	2.1
Mormon Mountain	11R3-M	7500	4/12	6	2.1
Mormon Lake *	11R4	7350	4/12	T	T
Fort Valley *	11P2	7350	4/13	0	0.0
Mingus Mountain	12R3	7100	4/13	0	0.0
Chalender	12P1-M	7100	4/15	T	T
Casner Park	11R2-M	6930	-	-	-
Munds Park	11R1-M	6500	4/11	0	0.0
LITTLE COLORADO RIVER					
Ft. Apache	9R5	9160	4/13	27	10.4
Baldy	9S1	9125	4/13	22	8.7
Happy Jack *	11R5	7630	4/13	0	0.0
Heber	10R4	7600	4/12	3	1.1
Canyon Creek #2	10R7-M	7500	4/12	1	0.5
Mormon Mountain	11R3-M	7500	4/12	6	2.1
Mormon Lake	11R4	7350	4/12	T	T
Fort Valley	11P2	7350	4/13	0	0.0
McNary	9R2-M	7200	4/12	T	T
Forest Dale	10R6	6430	4/12	0	0.0

* On Adjacent Drainage

PRECIPITATION AT SELECTED ARIZONA STATIONS **

STATION	Precipitation (Inches) March - 1962 Total	Departure from long term mean	Current Water-Year (Oct.1961 - Mar.1962) Total	Departure from long term mean
Ash Fork	.58	- .47	5.95	+ .15
Clifton	.80	+ .09	9.68	+ 4.90
Douglas Smelter	.59	+ .16	5.08	+ 1.54
Flagstaff WBAS *	1.30	- .27	14.57	+ 5.36
Grand Canyon Hdq.	.85	- .59	7.23	- .29
Parker	.03	- .52	2.05	- .90
Payson Ranger Station	1.86	+ .07	11.84	+ 1.32
Phoenix WBAS	.50	- .16	3.58	- .31
Prescott WBAS	.75	- .23	5.17	- .91
Springerville	.33	- .31	8.18	+ 4.69
Tucson WBAS	.25	- .43	4.63	+ .23
Winslow WBAS	.48	+ .08	3.91	+ 1.16
Yuma WBAS	.17	- .09	2.21	+ .32

* WBAS = Weather Bureau Airport Station

** Data and Analysis furnished by Paul C. Kangeiser, Arizona State Climatologist, U. S. Weather Bureau, Phoenix, Arizona.

The Following Organizations Cooperate in the Arizona Snow Survey Work

FEDERAL

Department of Agriculture

Soil Conservation Service

Forest Service
- Apache Forest
- Coconino Forest
- Coronado Forest
- Gila Forest
- Kaibab Forest
- Prescott Forest
- Rocky Mountain Forest and Range Experiment Station
- Tonto Forest

Department of Commerce
- Weather Bureau
  - Arizona Section

Department of Interior

Bureau of Reclamation
- Region III

Geological Survey
- Arizona District

Bureau of Indian Affairs
- Fort Apache Reservation
- San Carlos Irrigation Project

National Park Service
- Grand Canyon National Park

Gila Water Commissioner
Safford, Arizona

STATE

Arizona Agricultural Experiment Station

IRRIGATION PROJECTS

Salt River Valley Water Users' Association
Phoenix, Arizona

San Carlos Irrigation and Drainage District
Coolidge, Arizona

PRIVATE

Southwest Lumber Mills, Inc.
McNary, Arizona

Other organizations and individuals furnish valuable information for the snow survey reports. Their cooperation is gratefully acknowledged.

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SOIL CONSERVATION SERVICE
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PHOENIX 25, ARIZONA

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